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The Eastern Regional Research Laboratory

The Eastern Regional Research Laboratory of the U. S. Department of Agriculture is one of four research institutions created by Congress in 1938 to find new industrial uses and wider markets for agricultural products. At that time large annual surpluses of many crops had become one of the serious problems of American agriculture. Extensive new outlets for these products were needed. The four large research institutions were established to find such outlets in industry. Called Regional Research Laboratories, one was placed in each major farm region of the country—Northern, Southern, Eastern, and Western—and assigned the task of studying the products of the area.

The Eastern Regional Research Laboratory is located in Wyndmoor, Pa., adjacent to the Chestnut Hill section of Philadelphia. The Laboratory proper is a three-story U-shaped brick building housing 72 research laboratories and a pilot plant. The pilot plant occupies an entire wing, or about one third of the building. At present the staff numbers 276, of whom 171 are professional or sub-professional employees.

The commodities studied are apples, potatoes, tobacco, milk products, animal fats and oils, vegetables, and hides, tanning materials and leather. Because of the great diversity of constituents in these products, the research organization and assignment of problems are based largely on commodities.

The research work is divided among seven major divisions: Biochemical; Protein; Carbohydrate; Oil and Fat; Hides, Tanning Materials and Leather; Analytical and Physical Chemistry; and Chemical Engineering and Development. The last two Divisions deal with problems pertaining to all the commodities.

The following are some of the accomplishments of the Eastern Laboratory since the work was started in 1940.

Improved Emulsifiers in the Manufacture of Synthetic Rubber

Approximately 100 million pounds of tallow soaps are required annually as emulsifiers in the production of GR-S synthetic rubber. Investigations undertaken at the request of the Rubber Reserve Company and conducted in cooperation with several universities and rubber companies demonstrated that the cause for erratic behavior in the emulsion polymerization process was the variable content of polyunsaturated fatty acids in the soaps. Solution of the problem by partial and selective hydrogenation of the tallow was thus indicated, and this was confirmed, both in laboratory and pilot-plant tests. Improved spectrophotometric procedures were devised

for the accurate analysis of the tallow fatty acids and soaps in question, and the methods are now being used by industry for control purposes.

On the basis of this work, new specifications for the soaps have been drawn up, and it is expected that within a short time industry will be able to furnish all needed stocks conforming to the new standards. The time required for polymerization has been reduced substantially, with a resultant significant increase in production, and elimination of variability in the emulsifier has tended toward uniformity in the finished rubber. Moreover, it is now possible to meet this huge demand out of inedible stocks, whereas formerly allocation of some edible fat for this purpose was necessary. Incidentally, this joint investigation represents one of the many fine examples of cooperative effort and achievement between university, industrial, and Government research groups during the war. No single group could have done it without great loss of time; jointly it was done quickly, and the results were put into practice without delay.

Rutin

Rutin, a rhamno-glucoside of quercetin, is a yellow pigment occurring in a number of plants. Our interest in this compound arose in connection with by-product utilization studies on tobacco. Although flue-cured tobacco contains up to about 0.6 percent, the rutin content of the air-cured types is much smaller. In some of these no rutin could be found. Based on structural considerations, it was thought that rutin might have a physiological activity in the treatment of increased capillary fragility similar to that ascribed to Vitamin P. Clinical investigations made in cooperation with Dr. J. Q. Griffith, Jr. of the University of Pennsylvania Medical School have shown rutin to be an effective therapeutic agent in the treatment of increased capillary fragility; it has been especially useful in treating persons subject to retinal hemorrhages and apoplexy. A great deal of interest about rutin has been aroused in the medical profession. Rutin is also undergoing clinical tests for the treatment of other conditions associated with capillary disorders.

In anticipation of a need for larger quantities of rutin to permit further clinical use, a more economic source of this compound was sought. In the summer of 1944 it was found that buckwheat is an excellent source of rutin, the leaves and flowers of this plant containing on the average about 4 per cent. Laboratory extraction procedures were adapted to pilot-plant operations, and approximately 20 pounds of rutin was prepared. As a result, several large drug

companies undertook the manufacture of rutin from buckwheat during the past summer.

Bland Apple Sirup

At the outset of the war an investigation on the production of full-flavored sirups and concentrates was shifted to develop instead a bland apple sirup suitable for sweetening purposes. A simple process for making such a product was completed in the spring of 1942. Curtailment of glycerine supplies had forced cigarette manufacturers to seek substitutes for this material, and the new bland sirup proved to be satisfactory for the purpose. Commercial production of the sirup was started immediately, and during the 1942-43 season approximately 2.5 million pounds was produced by six companies in the United States and Canada. Production facilities with an estimated capacity of 20 million pounds were available the following year, but because of the short apple crop and other conditions only 3½ million pounds was manufactured. With the easement of glycerine supplies for civilian use, production of the sirup fell to about 2 million pounds during the 1944-45 season, practically all of which was consumed by the tobacco industry. Under normal conditions, other uses for bland and modified apple sirups are expected to provide a substantial outlet for cull and surplus apples.

Apple Essence

In 1944 attention was again directed to the problem of producing full-flavored apple concentrate and sirup. This has been achieved by a process for the recovery of apple flavor as an aqueous concentrate containing 100 to 200 times the aroma of fresh apple juice. When the essence is added to apple concentrate and properly diluted with water, the product is a beverage which cannot be distinguished from fresh apple juice. In connection with this product the National Apple Institute, at its Annual Meeting in June 1945, adopted the following resolution:

"The National Apple Institute wishes to draw the attention of apple growers, apple processors, juice distributors, and juice retailers to the fact that, for the first time in the history of the apple industry, fresh apple juice can now enter the fountain trade through the national manufacture and distribution of 'Full Flavor Apple Concentrate.'"

Casein Bristle Fiber

The acute shortage of natural bristle fiber during the war has stimulated efforts to develop substitute materials. In addition to our investigations on casein fiber for textile use, studies were undertaken to produce a fiber of bristle dimensions suitable for use as paint brushes, as well as for brushes of other types. A process was developed for the extrusion of a casein filament which, after stretching and hardening, has sufficient strength and flexibility for paint brushes. Tests have shown that casein bristles have good paint-carrying and spreading characteristics and are equal to natural bristle in abrasion resistance. They can be used with oil-base paints but are not suitable for the application of water-type coatings. The manufacturing process is being further developed, and commercial operations may soon be undertaken.

Allyl Starch

Among the derivatives of starch which we have investigated, allyl starch is one which appears to

have considerable potential utility in the coating field. This resin is prepared by the reaction of starch with allyl chloride under pressure in the presence of strong alkali and a suitable solvent. The product is recovered as a soft gummy mass which contains an appreciable amount of water. When properly dehydrated, the material is soluble in a wide variety of organic solvents, and when suitably formulated can be applied as a coating for wood, metal, and paper. Cured films of allyl starch have superior resistance to organic solvents, oils and acids, as well as hot and cold water. Allyl starch as a coating material possesses the unique advantage of rapid air drying coupled with oxidative hardening. This coating has excellent spot resistance to agents such as acetone, ether, carbon tetrachloride and alcohol, which blemish many types of finishes. Moreover, it is not marred by hot dishes under ordinary household conditions. Allyl starch may be modified by mixing and curing it with sulphur, accelerators, and other rubber-compounding ingredients. "Vulcanization" with heat and pressure yields an interesting thermosetting-type plastic. It may be possible to use this plastic with fibrous or other sheet materials in the preparation of laminates. These properties, combined with potential low-cost production, have stimulated unusual industrial interest in allyl starch. This whole development, however, is still in the experimental stage.

New Oil-Soluble Derivatives of Nicotine

Nicotine, the most characteristic constituent of tobacco, has been studied extensively in our tobacco-utilization work. Two new catalytic processes were developed for the oxidation of nicotine, with resultant improvement in the production of either nicotinic acid or nicotinamide. It is believed there would be important advantages in having a water-insoluble form of this vitamin available for the fortification of certain foods. Water-insoluble derivatives of these two nutritionally important compounds have therefore been prepared and, in cooperation with the National Research Council, are being tested for biological activity. The most important uses for nicotine, however, probably will continue to be in the insecticide field, and hence in our work a great deal of attention has been given to the synthesis of new types of nicotine derivatives. One of these, the oil-soluble, water-insoluble type of the nicotinamino class of compounds, may provide what entomologists have sought for years—a form of nicotine which will remain in the oil phase of an oil emulsion spray. Another group of compounds, the quaternary nicotinium salts, have only moderate insecticidal effectiveness; however, several compounds of this class appear to have considerable merit as fungicides.

Leaf Meal Feeds from Vegetable Wastes

Large tonnages of vegetable wastes occur annually in the commercial growing and processing of vegetables, and our investigations on this commodity have been concerned with improved methods of utilizing such wastes. The leaf tissues of vegetables are high in protein, carotene, and riboflavin, whereas the stems and midribs contain relatively small amounts of these valuable substances. With this in mind, a process was developed whereby the thin leafy fractions may be easily segregated, yielding a high quality leaf meal. The process, which may

be continuous, consists of a flash drying operation during which the leaves are embrittled, leaving the stems moist and tough; the dried leaves are then removed through a rotating screen equipped with a breaking device. Tests conducted in cooperation with the Delaware Agricultural Experiment Station have demonstrated the value of a number of such vegetable leaf meals as poultry feeds. This use is expected to provide an important new outlet for vegetable wastes.

New Products from Lactic Acid

Lactic acid, produced from lactose in whey and from other carbohydrates by fermentation, has been used as raw material for the synthesis of many new compounds which have potential usefulness, for example, as resins, coatings, adhesives, plasticizers, and synthetic rubber. Reactions involved in the conversion of lactic acid to acrylic acid esters have been subjected to intensive study, and conditions necessary for efficient product yields have been established. These processes have been undergoing further pilotplant development by several industrial concerns. The acrylic acid esters, now produced almost entirely from other sources, are used extensively for the manufacture of acrylic resins, which are characterized by their water-white clarity, their unusual adhesive and elastic properties, and stability to light and moderate heat. Several different types of synthetic rubber have been prepared from the acrylates, and their properties have been investigated.

PAPER AND PACKAGING SPECIFICATIONS

(153) Army and Navy Specifications

Chicago Quartermaster Depot

- CQD-91B (Amend. 1, Oct. 22, 1946) Cheese, Process
- CQD-119D (Amend. 2, Nov. 29, 1946) Macaroni and Spaghetti
- CQD-126A (Amend. 1, Oct. 16, 1946) Ration, Five-in-One
- CQD-183B (Amend. 2, Oct. 22, 1946) Ration, Type C; Assembly, Packaging, and Packing
- CQD-303B (Amend. 1, Nov. 6, 1946) Chicken and Vegetables
- CQD-309B (Oct. 16, 1946) Hamburgers, Canned
- CQD-327 (Amend. 2, Oct. 16, 1946) Oil, Vegetable, Salad
- CQD-350A (Amend. 3, Aug. 29, 1946) Canned Subsistence Items, Packaging and Packing, For Overseas Shipment
- CQD-358 (Amend. 2, Aug. 27, 1946) Cheese Spread, Canned
- CQD-397 (Aug. 20, 1946) Juice, Orange; Frozen
- CQD-398 (Aug. 27, 1946) Ration, Type E, Complete (Combat), Assembly, Packaging and Packing
- CQD-399 (Aug. 29, 1946) Bread, Canned
- CQD-400 (Sept. 10, 1946) Cream, Stabilized, Sterilized

(70) Revision of Constitution

A large number of ballots were received relative to the proposed revisions to the TAPPI Constitution (see TAPPI Bulletin No. 68, July 31, 1946). There were two negative votes out of several hundred cast. A few good suggestions were received in reference to improved wording of some of the articles and sections. The changes proposed are now effective.

(71) Revision of TAPPI By-Laws

Amendments to the Association By-Laws are made by the Executive Committee. The following changes were first approved on February 24, 1946 and reaffirmed on December 6, 1946, after amendments to the Constitution were approved by vote of the active and corporate members of the Association.

Article II—Executive Committee

Section 3. (Present) The Executive Committee shall meet at the time of the annual and fall meetings and at such other times as may be required by the officers or upon written request of three members of the Executive Committee.

Authorized Change: omit — and fall and remove letter — s from meetings

Certain vulcanizates of the saturated acrylic copolymers have excellent resistance to oils, oxygen, and aging at normal and elevated temperatures. This rubber, which we call "Lactoprene," also has unusually good flex life and cut-growth resistance. The early disadvantage of slow vulcanization has been overcome by recently developed methods which permit vulcanization within five minutes. Considerable industrial interest in this product has been evident.

Mold-Resistant Treatment for Leather

At the request of the Office of Ordnance of the War Department, work was undertaken to develop a mold-resistant treatment for leather carrying cases and other leather ordnance items. The need for protection against molds was particularly acute in hot, humid combat areas in the Pacific. Many combinations of fungicides, solvents, and waxes were tested before a satisfactory one was found. Leather articles treated by dipping in this fungicide-wax-solvent solution proved highly resistant to attack by molds, both in laboratory and field tests. Water absorption was also greatly reduced. The treatment was found applicable to fabricated cases, thus making it possible to protect large lots of cases already manufactured.

NOTE: This article was prepared for the TAPPI Bulletin by P. A. Wells, Director of the Eastern Regional Research Laboratory, Wyndmoore, Pa.

NOTE: An article on the Northern Regional Research Laboratory appeared in TAPPI Bulletin No. 55 (June 30, 1945).

- CQD-427 (Aug. 13, 1946) Packaging and Packing of Machines, Computing, Desk Type and Portable Type With Carrying Case

(154) Federal Specifications

- UU-C-128a (Sept. 20, 1946) Cards; Index

NOTE: This restores the prewar weight of cards

- UU-C-620 (Nov. 15, 1946) Covers; Headrest (Dental Chair), Paper

- UU-P-121d (Sept. 29, 1946) Paper; Bond, White and Colored
- UU-P-288a (Sept. 20, 1946) Paper; Ledger

NOTE: In addition to changes made to restore prewar requirements a 100% rag ledger paper for permanent records has been added. The same change has been made in the specification for bond paper. A new type of wood fiber paper, having the same requirements as the 25% rag bond, has also been added, and the 75% rag paper has been deleted.

- UU-P-301a (July 9, 1946) Paper; Legal-Cap, Ruled
- UU-P-328b (Sept. 20, 1946) Paper; Manifold
- UU-P-641a (Amend. 1, Sept. 30, 1946) Paper; Writing

ACTIVITIES OF THE TECHNICAL ASSOCIATION

Article III—Election of Members

Section 3. (new) **A junior, associate, or affiliated member may, when fully qualified, make application for active grade on a form authorized by the Executive Committee for this purpose.**

Change present Sections 3 and 4 to Sections 4 and 5 respectively.

Section 4. (Present) All applications for memberships or change in grade, together with the reports of the references and the results of the investigations, shall be presented to the Executive Committee which shall act thereon, assigning the applicant to the grade to which, in their judgment, his qualifications entitle him. Upon approval of the Executive Committee junior members who have attained the age of twenty-eight years and who shall be otherwise qualified shall be transferred to associate membership.

Authorized change: **Twenty-seven instead of twenty-eight**

Article IV—Initiation Fees and Dues

Initiation fees and annual dues for each grade of membership shall be as follows:

Initiation Fee: (Present)

Active, associate, junior, and affiliated members \$ 5.00

Annual Dues

Active, associate, and affiliated members 15.00
Junior members 5.00

Authorized changes:

Initiation Fee — add — and overseas members	5.00
Annual Dues — add — overseas members	15.00
Change — Junior members	7.50

Article IX—Meetings of the Association

Authorized Change: **Delete this Article since they duplicate conditions provided for in the Constitution**

Change **Articles X, XI, XII, XIII, XIV to Articles IX, X, XI, XII, XIII, respectively.**

(72) TAPPI Statistics Committee

The use of Statistical Methods received a great impetus as a result of World War II. In few other branches of science could one point so definitely to the development of new techniques and to the wide adoption of old procedures. There appeared a general appreciation of the power of statistical methods.

The wide extension in the use of statistical methods during the recent war was made particularly towards control in process, the field usually termed quality control and associated with W. A. Shewhart. These methods were developed and have been used most in the control of the products that are made up of many individual units. Electrical equipment is a particular example of such a class of products. Obviously, the production of pulp and paper is a somewhat different matter. Nevertheless, there seems to be no reason, why by making new adaptations of conventional methods and by developing experience with these methods, the pulp and paper industry should not take profitable advantage of them.

Some idea of the importance attached to the use of the foregoing methods in some segments of American industry may be conveyed by describing briefly a regional meeting in March 1946 of the American Society for Quality Control at Chicago. About one thousand industrial engineers interested in statistical methods attended a two day conference on quality control. There were three men from paper mills in attendance.

Almost as important as the recent extension in the use of Quality Control, in process, has been that of the use of statistical methods in connection with inspection and specification.

An increased awareness of the value of quality control in industry on the part of educational institutions is shown by the numerous short courses that have been offered to representatives of industry.

A typical example of these intensive short courses was the one offered by the University of Iowa, October 15-25th. Incidentally, this course just closed is the fourth such session that has been offered at this school.

The course consisted of lectures, discussion groups and laboratory work under the direction of a distinguished faculty committee. The theme of the course was the adaptation of quality control by statistical methods to new industrial fields.

A unique feature of the course was the arrangements for the opening day. These were designed to interest executives who may have accompanied candidates from their company.

A field of statistical endeavor that has not attracted particular recent attention is that of relating the character of a product at one stage of fabrication to that at another. Nevertheless, this field should find much application in paper making. The most progressive mills have raised problems for themselves by making many tests on their product; the results from various

tests must be reconciled and be subjected to simultaneous consideration with an eye to later tests. Precisely, what relationship do the tests on pulp bear to the character of paper?

The Technical Association has recognized the growing importance of the use of statistical methods in the industry. As a concrete step designed to assist in this matter, TAPPI has sponsored a new sub-committee to work in this field. T. A. Pascoe, Technical Director of Nekoosa-Edwards Paper Company, has accepted the chairmanship of the new committee. There are eight members of the committee and one associate member. These were chosen from different parts of the country representing men who were known to be interested in the field and have some proficiency in the use of statistical methods.

The committee first assembled during the TAPPI Detroit Meeting and adopted a four point program. The first object is a promotion program to increase general appreciation of the power and utility of statistical methods. The second aim involves sponsoring studies to adapt the methods to routing inspection and control in the industry. The third part of the program is one of adapting methods to use in research and development work. Finally there is the intention of setting up a consulting service to assist the other TAPPI Committees along any of the lines mentioned above.

The new committee whose title is "Committee on Statistical Methods" is planning to present a half day program and round table discussion at the February Meeting.

(73) Containers Committee

W. B. Lincoln, Jr., Development Engineer for the Inland Container Corporation, Indianapolis, Ind., has been appointed chairman of the TAPPI Containers Committee. This committee which has been without a chairman for the past year will be completely reorganized and a new program of activities established. Under the previous chairmanship of J. D. Malcolmson of the Robert Gair Company and Arno W. Nickerson, Consulting Engineer, it carried on an excellent program that was closely related to the war effort. Its aggressive program during the war contributed heavily to the award to the Association of the United States Navy's Certificate of Achievement. Any member of the Association who is actually engaged in the manufacture of heavy containers will be considered for membership on this recognized committee. Its work is not planned to duplicate the work of the present Containers Testing Committee of which Don L. Quinn is Chairman.